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Supplement

MORBIDITY AND MORTALITY WEEKLY REPORT

NIOSH
Recommendations
for
Occupational Safety
and
Health Standards

U.S. Department of Health and Human Services
Public Health Service
National Institute for Occupational Safety and Health
Centers for Disease Control
Atlanta, Georgia 30333

INTRODUCTION

Acting under the authority of the Occupational Safety and Health Act of 1970 (Public Law 91-596), the National Institute for Occupational Safety and Health (NIOSH) develops, and periodically revises, recommendations for limits of exposure to potentially hazardous substances or conditions in the workplace. It also recommends preventive measures designed to reduce or eliminate adverse health effects of these hazards. In formulating these recommendations, NIOSH evaluates all known and available scientific information relevant to the potential hazard. These recommendations are then published and transmitted to the Department of Labor, Occupational Safety and Health Administration (OSHA) for use in promulgating legal standards.

NIOSH recommendations are published in a variety of documents. Criteria Documents specify a NIOSH recommended exposure limit (REL) and appropriate preventive measures designed to reduce or eliminate adverse health effects. Special Hazard Reviews, Occupational Hazard Assessments, and Technical Guidelines are other types of documents published by NIOSH which complement the Institute's recommendations for standards. These documents provide assessments, from a safety and health standpoint, of specific problems associated with a given agent or hazard, and recommend control and surveillance methods.

Although these documents do not supplant the more comprehensive Criteria Document, they are prepared in such a way as to assist OSHA in the formulation of regulations. NIOSH also periodically presents testimony before various Congressional committees and at regulatory hearings convened by OSHA. The testimony presented always includes the current NIOSH policy concerning the particular hazard in question.

NIOSH also publishes documents known as Current Intelligence Bulletins (CIB) which review and evaluate emerging information on occupational hazards. Each CIB is based on rapid evaluation of new and changing information on a particular hazard in light of existing knowledge.

The *NIOSH Recommendations for Occupational Safety and Health Standards* is based on existing NIOSH policy as previously published in any of the forms listed above. The intent of this table is to provide, in rapid-reference form, the most recent NIOSH REL for each potential hazard. The current OSHA permissible exposure limit (PEL) is also presented. Unless otherwise noted in the table, the NIOSH recommendations were originally published in Criteria Documents.

Note to Readers:

Copies of NIOSH publications are generally available from the U.S. Government Printing Office and the National Technical Information Service. Single copies of these publications may be obtained (while the supply lasts) from:

Publications Dissemination
Division of Standards Development
and Technology Transfer
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, Ohio 45226
(513) 841-4287

Please enclose a self-addressed mailing label with your request.

Definitions of abbreviations and terms used in this publication:

Action level	the level of exposure at which certain provisions of the proposed standards must be initiated, such as periodic measurements of worker exposure, training of workers, and medical surveillance (if appropriate for the particular substance)
CFR	Code of Federal Regulations
CIB	Current Intelligence Bulletin
dBA	decibel, weighted according to the A scale, which approximates the response of the human ear
ECG	electrocardiogram
J/cm ²	joules per square centimeter
μg/m ³	micrograms per cubic meter
mg/m ³	milligrams per cubic meter
mppcf	millions of particles per cubic foot
mW/cm ²	milliwatts per square centimeter
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit (OSHA)
ppb	parts per billion
ppm	parts per million
REL	recommended exposure limit (NIOSH)
(Skin)	potential contribution to overall exposure by the cutaneous route including mucous membranes and eyes
TWA	time-weighted average
WBGT	wet bulb globe temperature

**SUMMARY OF OSHA REGULATIONS
FOR OCCUPATIONAL SAFETY AND HEALTH**

Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit
Acetylene (July 1976)	2,500 ppm (10% of lower explosive limit)	No exposure limit (2,662 mg/m ³)
Acrylamide (October 1976)	0.3 mg/m ³ , 8-hr TWA (Skin)	0.3 mg/m ³ TWA
Acrylonitrile (September 1977; revised March 1978 as part of NIOSH testimony at OSHA hearing)	2 ppm, 8-hr TWA; 10 ppm ceiling (15 min) (Skin)	1 ppm 8-hr TWA; ceiling (15 min)
Aldrin/dieldrin (Special Hazard Review September 1978)	0.25 mg/m ³ , 8-hr TWA (Skin)	Lowest reliable level; 0.15 mg/m ³ by NIOSH-voluntary
Alkanes (C5-C8) (March 1977)	Pentane: 1,000 ppm (2,950 mg/m ³); n-hexane: 500 ppm (1,800 mg/m ³); n-heptane: 500 ppm (2,000 mg/m ³); octane: 500 ppm (2,350 mg/m ³), 8-hr TWA	All are TWA Pentane: 12 ppm hexane: 100 ppm heptane: 85 ppm octane: 75 ppm mixtures not to exceed 350 mg/m ³

**REGULATIONS AND NIOSH RECOMMENDATIONS
AL SAFETY AND HEALTH STANDARDS, 1985**

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NIOSH Recommendations

Recommended Limit(s)[†]	Health Effect(s) Considered	Comments
posure > 2,500 ppm (mg/m ³)	Asphyxia	Employers to check for and inform workers of contaminants such as arsine and phosphine
/m ³ TWA	Skin, eye, and nervous system effects	Skin and eye contact to be prevented
8-hr TWA; 10 ppm (15 min) (Skin)	Brain tumors; lung and bowel cancer	Chest X-ray required; first- aid and medical kits to be available during use; skin contact should be prevented
not reliably detectable 0.15 mg/m ³ TWA NIOSH-validated method	Cancer	Aldrin/dieldrin no longer produced in U.S.; skin contact to be prevented
TWA values: : 120 ppm (350 mg/m ³); : 100 ppm (350 mg/m ³); : 85 ppm (350 mg/m ³); : 75 ppm (350 mg/m ³) es not to exceed g/m ³ TWA;	Skin and nervous system effects	Action level defined as 200 mg/m ³ for these substances

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All are ceiling values (15 min)
 singly or mixtures:
 pentane: 610 ppm (1,800 mg/m³)
 hexane: 510 ppm (1,800 mg/m³)
 heptane: 440 ppm (1,800 mg/m³)
 octane: 385 ppm (1,800 mg/m³)

Allyl chloride (September 1976)	1 ppm (3 mg/m ³), 8-hr TWA	1 ppm (3.1 mg/m ³) TW (9.3 mg/m ³) ceiling (15 min)
Ammonia (July 1974)	50 ppm (35 mg/m ³), 8-hr TWA	50 ppm (34.8 mg/m ³) ceiling (5 min)
Animal rendering processes (Occupational Hazard Assessment March 1981)	Existing OSHA PEL's or NIOSH REL's for specific hazards at the time of the assessment	
Antimony (September 1978)	0.5 mg/m ³ , 8-hr TWA	0.5 mg/m ³ TWA
Arsenic, inorganic (September 1974; revised June 1975; reaffirmed July 1982 as part of NIOSH testimony at OSHA hearing)	10 µg/m ³ , 8-hr TWA	2 µg As/m ³ ceiling (15 min)

*Date recommendation made

†NIOSH TWA recommendation

es (15 min)

(1,800 mg/m³);
(1,800 mg/m³);
(1,800 mg/m³);
1,800 mg/m³)

) TWA; 3 ppm
g (15 min)

m³)

ards are applicable

g (15 min)

ndation was transmitted to OSHA in parentheses.

ommendations are based on exposures up to 10 hours unless otherwise noted.

Liver, kidney, and
lung effects

Respiratory
irritation

Mechanical injury; burns;
heat stress; infections
from biologic agents;
chemical hazards

Irritation; heart and
lung effects

Lung and lymphatic
cancer; dermatitis

Urine, blood, and pulmonary
function testing required

Eye contact should
be prevented

Guidelines for engineering
controls and work practices
to reduce injury and
illness presented

Chest X-ray, pulmonary
function testing, and
electrocardiogram required

Chest X-ray required

Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Arsine (CIB August 1979)	0.2 mg/m ³ (0.05 ppm), 8-hr TWA	2 µg As/m ³ ceiling (15 min)
Asbestos (January 1972; revised September 1976; revised March 1984 as part of NIOSH testimony at Congressional hearing; reaffirmed June 1984 as NIOSH testimony at OSHA hearing)	2 million fibers/m ³ , over 5 µm in length, 8-hr TWA; 10 million fibers/m ³ ceiling	100,000 fibers/m ³ in length, 8-hr TWA 400 liter air sample
Asphalt fumes (September 1977)	See Coal-tar products	5 mg/m ³ ceiling maximum total particulate (15 min)
Benzene (July 1974; revised August 1976; revised July 1977 as part of NIOSH testimony at OSHA hearing)	10 ppm, 8-hr TWA; 25 ppm acceptable ceiling; 50 ppm maximum ceiling (10 min)	1 ppm (3.2 mg/m ³) ceiling (60 min)

NIOSH Recommendations

Recommended Exposure Limit(s) [†]	Health Effect(s) Considered	Comments
15 min	Sudden extensive hemolysis	Workers to be warned of working with arsenic compounds in presence of freshly formed hydrogen
/m ³ over 5 µm TWA in a sample	Asbestosis; lung cancer; mesothelioma	None
g measured as e (15 min)	Eye and respiratory irritation	Medical surveillance required; skin contact to be prevented
/m ³))	Blood changes including leukemia	Blood testing required

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Benzidine-based
dyes (Special
Hazard Review
November 1979;
reaffirmed
January 1983)

Not controlled as such

Reduce exposure to
lowest feasible level;
replace with less
toxic materials

Benzoyl
peroxide
(June 1977)

5 mg/m³, 8-hr TWA

5 mg/m³ TWA

Benzyl chloride
(August 1978)

5 mg/m³ (1 ppm),
8-hr TWA

5 mg/m³ ceiling (15

Beryllium
(June 1972;
revised
August 1977 as
part of NIOSH
testimony at
OSHA hearing)

2 µg/m³, 8-hr TWA;
5 µg/m³ acceptable
ceiling; 25 µg/m³
maximum ceiling (30 min)

Not to exceed 0.5 µg/m³

Boron
trifluoride
(December 1976)

1 ppm (3 mg/m³) ceiling

No exposure limit re-
due to the absence of
reliable monitoring n

1,3-Butadiene
(CIB February
1984)

1,000 ppm (2,200 mg/m³),
8-hr TWA

Reduce exposure to
lowest feasible level

*Date recommendation

†NIOSH TWA recom

are to level; s	Cancer	Urine monitoring suggested
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	Respiratory and eye irritation; skin effects	None
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g (15 min)	Irritation; skin and eye effects	Chest X-ray and pulmonary function testing required
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0.5 $\mu\text{g}/\text{m}^3$	Lung cancer	Pulmonary function testing, chest X-ray, and sputum cytology required
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mit recommended ence of a ring method	Respiratory effects	Appropriate engineering and work-practice controls to reduce exposure to lowest feasible level; pulmonary function testing required
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are to level	Cancer; teratogenicity; reproductive effects	Appropriate engineering and work-practice controls; restrict access to areas where 1,3-butadiene is used
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Recommendation was transmitted to OSHA is in parentheses.

Recommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommendation Exposure Limit(s) [†]
Cadmium (August 1976; revised in CIB September 1984)	Fume: 0.1 mg/m ³ , 8-hr TWA; 0.3 mg/m ³ ceiling; dust: 0.2 mg/m ³ , 8-hr TWA; 0.6 mg/m ³ ceiling	Reduce exposure to lowest feasible level
Carbaryl (September 1976)	5 mg/m ³ , 8-hr TWA	5 mg/m ³ TWA
Carbon black (September 1978)	3.5 mg/m ³ , 8-hr TWA	3.5 mg/m ³ TWA; 0.1 TWA in presence of po aromatic hydrocarbon
Carbon dioxide (August 1976)	5,000 ppm (9,000 mg/m ³), 8-hr TWA	10,000 ppm (18,000 30,000 ppm (54,000 ceiling (10 min)
Carbon disulfide (May 1977)	20 ppm, 8-hr TWA; 30 ppm acceptable ceiling; 100 ppm maximum ceiling (30 min)	1 ppm (3 mg/m ³) TWA (30 mg/m ³) ceiling (1
Carbon monoxide (August 1972)	50 ppm (55 mg/m ³), 8-hr TWA	35 ppm (40 mg/m ³), 200 ppm (229 mg/m ³) (No minimum time)
Carbon tetrachloride (December 1975; revised June 1976)	10 ppm, 8-hr TWA; 25 ppm acceptable ceiling; 200 ppm maximum ceiling (5 min in 4 hr)	2 ppm (12.6 mg/m ³) 45 liter sample (60 m

NIOSH Recommendations		
Exposure	Health Effect(s) Considered	Comments
Exposure to level	Lung cancer	None
	Central nervous system and reproductive system effects	Workers to be warned of possible effects on reproductive system and to have only minimum exposure during pregnancy; skin and eye contact to be prevented
0.1 mg/m ³ of polycyclic aromatic hydrocarbons	Lung, heart, and skin effects; cancer	Chest X-rays, pulmonary function testing, ECG, and sputum cytology required
0.000 mg/m ³ TWA; 0.000 mg/m ³	Respiratory effects	None
0.000 mg/m ³ TWA; 10 ppm ceiling (15 min)	Heart, central nervous system, and reproductive system effects	Workers to be advised of potential effects on reproductive system
0.000 mg/m ³ , 8-hr TWA; 0.000 mg/m ³ ceiling (15 min)	Heart effects	None
0.000 mg/m ³ ceiling (60 min)	Liver cancer	Recommended standard based on lower limit of detection

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Chlorine (May 1976)	1 ppm (3 mg/m ³) ceiling	0.5 ppm (1.45 mg/m ³) (15 min)
Chloroform (September 1974; revised June 1976)	50 ppm (240 mg/m ³) ceiling	2 ppm (9.78 mg/m ³) 45 liter sample (60 min)
Chloroprene (August 1977)	25 ppm (90 mg/m ³), 8-hr TWA	1 ppm (3.6 mg/m ³) ceiling (15 min)
Chromic acid (July 1973; revised—see Chromium (VI), December 1975)	1 mg/10 m ³ ceiling	25 µg/m ³ TWA; 50 µg/m ³ ceiling (15 min) as noncarcinogenic Cr
Chromium (VI) (December 1975)	100 µg chromates/m ³ ceiling	Carcinogenic Cr (VI): other Cr (VI): 25 µg/m ³ 50 µg/m ³ ceiling (15 min)
Chrysene (Special Hazard Review June 1978)	None	To be controlled as an occupational carcinogen
Coal gasification plants (September 1978)	OSHA PEL's or NIOSH REL's for specific hazards are applicable	

*Date recommendation made

†NIOSH TWA recommendation

g/m ³) ceiling	Eye and respiratory irritation	Chest X-rays required	Vol. 34/No. 15
(m ³) ceiling 30 min)	Liver or kidney tumors and central nervous system effects	None	
n ³) ceiling	Reproductive effects; potential for cancer	Chest X-ray and pulmonary function testing required; pregnant workers to be counseled about continuing work with chloroprene	
g (15 min) nic Cr (VI)	Nasal ulceration	None	MMWR
(VI): 1 µg/m ³ TWA; µg/m ³ TWA; g (15 min)	Lung cancer; skin ulcers; and lung irritation	Employer must demonstrate absence of carcinogenic Cr (VI); X-ray required	
as an carcinogen	Cancer	Document also contains control recommendations for polycyclic aromatic hydrocarbons	
e applicable	Various effects depending on substances present; carcinogenic potential	Extensive work-practice and control procedures recommended	

endation was transmitted to OSHA is in parentheses.

recommendations are based on exposures up to 10 hours unless otherwise noted.

Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Coal liquefaction, volumes I and II (Occupational Hazard Assessment June 1981)	OSHA PEL's or NIOSH REL's for specific hazards are applicable	
Coal-tar products (September 1977)	0.2 mg/m ³ , 8-hr TWA (benzene-soluble fraction)	0.1 mg/m ³ TWA (cyclohexane-extractable fraction)
Cobalt (Occupational Hazard Assessment November 1981)	0.1 mg/m ³ , 8-hr TWA	NIOSH has concluded that the available evidence is insufficient to warrant recommendation of an exposure limit
Coke oven emissions (February 1973; revised November 1975 as part of NIOSH testimony at OSHA hearing)	150 µg/m ³ , 8-hr TWA	0.5-0.7 mg/m ³ (total particulates) as screening level

NIOSH Recommendations

Recommended Health Effect(s) [†]	Health Effect(s) Considered	Comments
are applicable	Various effects depending on substances present; carcinogenic potential	Extensive work-practice and control procedures recommended
A extractable	Lung and skin cancer	Includes coal tar, creosote, and coal-tar pitch; pulmonary function testing and chest X-rays required
cluded that there vidence to mending a new	Dermatitis; potential for pulmonary fibrosis	Includes recommendations for engineering controls, work practices, protective equipment, worker education, monitoring, and medical surveillance
3 (total s l	Lung cancer	Sputum cytology and chest X-ray required; work practices to minimize exposure to emissions

Confined spaces, working in (December 1979)

Covered under numerous OSHA regulations for General Industry (29 CFR 1910)

Various recommendations including a permit system prevent worker injury and

Cotton dust (September 1974; reaffirmed September 1983 as part of NIOSH testimony at OSHA hearing)

Yarn manufacturing: $200 \mu\text{g}/\text{m}^3$, 8-hr TWA; slashing and weaving operations: $750 \mu\text{g}/\text{m}^3$, 8-hr TWA; all other operations: $500 \mu\text{g}/\text{m}^3$, 8-hr TWA

$200 \mu\text{g}/\text{m}^3$ lint-free cotton dust

Cresol (February 1978)

5 ppm ($22 \text{ mg}/\text{m}^3$), 8-hr TWA (Skin)

2.3 ppm ($10 \text{ mg}/\text{m}^3$) TWA

Cyanide, hydrogen and cyanide salts (March 1977)

Hydrogen cyanide: 10 ppm ($11 \text{ mg}/\text{m}^3$), 8-hr TWA (Skin); cyanide: $5 \text{ mg CN}/\text{m}^3$, 8-hr TWA (Skin)

4.7 ppm ($5 \text{ mg CN}/\text{m}^3$) ceiling (10 min)

DDT (Special Hazard Review September 1978)

$1 \text{ mg}/\text{m}^3$, 8-hr TWA (Skin)

Lowest reliably detectable level; $0.5 \text{ mg}/\text{m}^3$ TWA by NIOSH-validated method

*Date recommendation

†NIOSH TWA recom

utions
stem to
y and death

Injury and death

None

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Pulmonary disease
(byssinosis)

Pulmonary function
testing required

TWA

Skin, liver, kidney, and
pancreas effects

Applies to mixtures of
cresols and cresylic acid;
skin and eye contact to
be prevented; possible
delayed effects

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n³) ceiling

Thyroid; blood; respiratory
system effects

Concurrent measurement
required for HCN when
measuring for cyanide salt;
trained first-aid personnel
and first-aid kits to be
available during use;
skin and eye contact to be
prevented

ectable
NA by
ethod

Cancer

Skin contact to be prevented

ndation was transmitted to OSHA in parentheses.

ommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
2,4-Diaminoanisole and its salts (CIB January 1978)	None	Reduce exposure to lowest feasible level
Dibromochloropropane (September 1977)	1 ppb, 8-hr TWA; eye and skin contact to be avoided	10 ppb (0.1 mg/m ³) TWA
Di-2-Ethylhexyl phthalate (DEHP) (Special Hazard Review March 1983)	5 mg/m ³ , 8-hr TWA	Reduce exposure to lowest feasible level
Diisocyanates (September 1978)	Toluene diisocyanate (TDI): 0.02 ppm (0.14 mg/m ³) ceiling; diphenylmethane diisocyanate (MDI): 0.02 ppm (0.2 mg/m ³) ceiling	Each equivalent to 5 ppm TWA and 20 ppb ceiling. All values given in µg/m ³ ceiling values for 10 min: 35 TWA, 140 ceiling; MDI: 200 ceiling; hexamethylene diisocyanate (HDI): 35 TWA, 140 ceiling; naphthalene diisocyanate (NDI): 40 TWA, 170 ceiling; isophorone diisocyanate (IPDI): 45 TWA, 180 ceiling; dicyclohexyl diisocyanate (HMDI): 45 TWA, 180 ceiling; 4,4'-diisocyanate (hydrazide): 55 TWA, 210 ceiling. MDI: 55 TWA, 210 ceiling. diisocyanates also to be reduced to 20 ppb ceiling and 5

NIOSH Recommendations

Exposure Level	Health Effect(s) Considered	Comments
o el	Cancer	Skin contact to be prevented; engineering and work-practice controls are recommended
3) TWA	Sterility; renal and liver effects	Workers to be warned of reproductive system abnormalities, including sterility
o el	Cancer	DEHP, widely used in the quantitative fit testing of respirators, should be replaced with less toxic material such as refined corn oil
5 ppb ceiling, $\mu\text{g}/\text{m}^3$ and all 10 min: TDI: ing: MDI: 50 TWA, methylene : 35 TWA, thalene : 40 TWA, orone): 45 TWA, lohexylmethane (hydrogenated 0 ceiling; other to be controlled and 5 ppb TWA	Respiratory effects and sensitization; irritation	Chest X-ray and pulmonary function testing required

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Dinitro-
ortho-cresol
(February
1978)

0.2 mg/m³, 8-hr TWA
(Skin)

0.2 mg/m³ TWA

Dinitro-
toluene (CIB
July 1985)

1.5 mg/m³
8-hr TWA (Skin)

Reduce exposure to
lowest feasible level

Dioxane
(September
1977)

100 ppm (360 mg/m³),
8-hr TWA (Skin)

1 ppm (3.6 mg/m³) ca
(30 min)

Dioxin
(CIB January
1984)

None

Reduce exposure to
lowest feasible level

Elevated
workstations,
emergency
egress from
(December
1975)

Sections under
Subpart E, Means of
Egress, General Industry
Standards, and Subpart R,
Special Industries
(29 CFR 1910.261)

Various recommenda
concerning means and
availability of egress

Epichlorohydrin
(September
1976;
revised in
CIB October
1978)

5 ppm (19 mg/m³),
8-hr TWA

Minimize occupations
exposure

*Date recommended

†NIOSH TWA recom

	central nervous system and metabolic effects	Blood and urine monitoring required; skin and eye contact should be prevented; possible delayed effects
e to level	Cancer; potential for reproductive effects	Skin contact to be prevented
n ³) ceiling	Cancer; liver and kidney effects	Blood and urine testing required; skin contact should be prevented
e to level	Cancer; chloracne	None
endations s and ress	Trauma and injury	None
otional	Cancer; mutagenesis; reproductive effects; skin, kidney, liver, and respiratory effects	Skin contact should be prevented

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Recommendation was transmitted to OSHA is in parentheses.
Recommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Ethylene dibromide (August 1977; revised November 1983; reaffirmed February 1984 as part of NIOSH testimony at OSHA hearing)	20 ppm, 8-hr TWA; 30 ppm acceptable ceiling; 50 ppm maximum peak (5 min)	0.045 ppm (0.38 mg/m ³) 8-hr TWA; 0.13 ppm (1.1 mg/m ³) ceiling (15 min)
Ethylene dichloride (March 1976; revised in CIB April 1978; revised September 1978)	50 ppm, 8-hr TWA; 100 ppm acceptable ceiling; 200 ppm maximum ceiling (5 min in 3 hr)	1 ppm (4 mg/m ³) TWA; 2 ppm (8 mg/m ³) ceiling (15 min)
Ethylene oxide (Special Hazard Review September 1977; revised July 1983 as part of NIOSH testimony at OSHA hearing)	1 ppm (1.8 mg/m ³), 8-hr TWA	< 0.1 ppm (0.18 mg/m ³) 8-hr TWA; 5 ppm (9 mg/m ³) ceiling (10 min/day)
Ethylene thiourea (Special Hazard Review October 1978)	None	Should be used in encapsulated form in industry; worker exposure be minimized

NIOSH Recommendations

Exposure Situation	Health Effect(s) Considered	Comments
Exposure to dusts (1 mg/m ³)	Cancer; mutagenesis; damage to skin, eyes, heart, liver, spleen, and respiratory and central nervous systems	Workers to be warned of potential reproductive abnormalities and cancer; hazardous liquid; contact to be prevented
Exposure to vapors (1 mg/m ³)	Cancer; nervous system, respiratory, heart, and liver effects	Nursing infants of exposed mothers at risk
Exposure to dusts (1 mg/m ³)	Cancer; mutagenesis; reproductive effects	Blood monitoring and medical counseling recommended
Exposure to dusts (1 mg/m ³)	Carcinogenesis and teratogenesis	Workers to be informed of carcinogenic and teratogenic hazards; special attention to be given to thyroid function tests

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Excavations,
development of
draft construction
safety standards
for (Technical
Guideline
May 1983)

Many aspects covered under
OSHA regulations governing
excavations, trenching, and
shoring practices in the
construction industry
(29 CFR 1926, Subpart P)

Many work-practice
recommendations and
safety standards
for excavations

Fibrous glass
(April 1977)

15 mg/m³ total dust;
5 mg/m³ respirable
fraction (nuisance dust)

3 million fibers/m³;
(fibers \leq 3.5 μ m di-
 \geq 10 μ m length); 5
(total fibrous glass)

Fluorides,
inorganic
(June 1975)

2.5 mg/m³, 8-hr TWA

2.5 mg F/m³ TWA

Fluorocarbon
polymers,
decomposition
products
(September
1977)

None

Various recommenda-
tions emphasizing good
practices, engineering
and medical manage-

Formaldehyde
(December 1976;
revised in CIB
April 1981)

3 ppm, 8-hr TWA; 5 ppm
acceptable ceiling;
10 ppm maximum ceiling
(30 min)

Minimize workplace
levels; limit exposure
to lowest feasible le-

Furfuryl
alcohol
(March 1979)

50 ppm (200 mg/m³),
8-hr TWA

50 ppm (200 mg/m³)

*Date recommended

†NIOSH TWA re-

ectice
ons concerning
ds
s

Injury and death

None

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/m³ TWA
um diameter and
th); 5 mg/m³ TWA
(less)

Eye, skin, and respiratory
effects

NIOSH recommends that this
limit also apply to other
manmade fibers

WA

Kidney and bone effects

Urine monitoring required

ommendations
ood work
neering controls,
anagement

Lung effects; polymer
fume fever

Workroom air to be
monitored for inorganic
fluorides and hydrogen
fluoride

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place exposure
posure
ible level

Cancer

Medical surveillance;
skin protection

mg/m³) TWA

Respiratory effects

None

ommendation was transmitted to OSHA is in parentheses.

WA recommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Glycidyl ethers (June 1978; revised in CIB October 1978)	All values in ppm (mg/m ³): allyl glycidyl ether (AGE): 10 (45) ceiling; n-butyl glycidyl ether (BGE): 50 (270), 8-hr TWA; di-2,3-epoxypropyl ether (DGE): 0.5 (2.8), 8-hr TWA; isopropyl glycidyl ether (IGE): 50 (240), 8-hr TWA; phenyl glycidyl ether (PGE): 10 (60), 8-hr TWA	All are ceiling values (15 min) in ppm (mg/m ³): AGE: 9.6 (45) BGE: 4.4 (30) DGE: 0.2 (1) IGE: 50 (240) PGE: 1 (5)
Glycol ethers (CIB May 1983)	2-Methoxyethanol: 25 ppm (80 mg/m ³), 8-hr TWA (Skin); 2-Ethoxyethanol: 200 ppm (740 mg/m ³), 8-hr TWA (Skin)	Reduce exposure to lowest feasible level
Grain elevators and feed mills, occupational safety in (Technical Guideline September 1983; reaffirmed June 1984 as part of NIOSH testimony at OSHA hearing)	Many general aspects (e.g., protective equipment, dust control, etc.) covered under the numerous OSHA regulations for General Industry (29 CFR 1910)	Various recommendations control of combustible dusts and ignition sources; machine guarding, isolation and lockouts, bin entry, training, and personal protective equipment
Hexachloroethane (CIB August 1978)	1 ppm (10 mg/m ³), 8-hr TWA (Skin)	Reduce exposure to lowest feasible level

NIOSH Recommendations

died	Health Effect(s) Considered	Comments
g/m ³):	Cancer for DGE; skin and mucous membrane effects; sensitization potential; tumorigenesis and mutagenesis; possible hemopoietic and reproductive effects	Possible additive effects with mixtures; medical surveillance
l	Reproductive effects; teratogenicity	Skin contact to be prevented
dations for ible sources, isolation ntry, nal ent	Injury and death	Health hazards from exposure to fumigants, pesticides, and grain dust
o el	Cancer	None

Hot
environments
(June 1972)

None

Action levels: 79°F W
76°F WBGT (women)
limits for unimpaired
function

Hydrazines
(June 1978)

All values in ppm (mg/m³):
hydrazine: 1 (1.3), 8-hr
TWA; 1,1-dimethyl-
hydrazine: 0.5 (1.0), 8-hr
TWA; phenyl hydrazine:
5 (22), 8-hr TWA;
methyl hydrazine:
0.2 (0.35) ceiling

All are ceiling values
ppm (mg/m³): hydrazine
(0.04); 1,1-dimethyl
0.06 (0.15); phenyl h
0.14 (0.6); methyl hy
0.04 (0.08)

Hydrogen
fluoride
(March 1976)

3 ppm, 8-hr TWA

3 ppm (2.5 mg F/m³)
TWA; 6 ppm (5.0 mg
ceiling (15 min)

Hydrogen
sulfide
(May 1977)

20 ppm acceptable
ceiling; 50 ppm maximum
ceiling (10 min)

10 ppm (15 mg/m³)
ceiling (10 min)

Hydroquinone
(April 1978)

2 mg/m³, 8-hr TWA

0.44 ppm (2 mg/m³)
ceiling (15 min)

Identification
system for
occupationally
hazardous
materials
(December 1974)

Sections of Hazard
Communication and
Carcinogen Standards
may be applicable

Complete designation
occupationally hazar
materials

Isopropyl
alcohol
(March 1976)

400 ppm (980 mg/m³),
8-hr TWA

400 ppm (984 mg/m³)
800 ppm (1,968 mg
ceiling (15 min)

*Date recommended

†NIOSH TWA recom

°F WBGT (men)
(men); sliding-scale
impaired mental

Heat-induced illnesses

Recommendations include
acclimatization, strict
work practices, and
protective equipment

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lues (120 min) in
hydrazine: 0.03
ethyl hydrazine:
enyl hydrazine:
enyl hydrazine:

Liver, blood, eye, and
skin effects; cancer

Blood and urine monitoring
and chest X-ray required;
bowel examination for
some workers

F/m³)
0 mg F/m³)

Skin, eye, and
airway irritation;
bone effects

Pelvic X-ray (male
workers only) and
urine testing required

/m³)

Irritation; severe acute
effects involving nervous
and respiratory systems

Continuous monitoring
required if potential
exists for exposure to
≥ 70 mg/m³; evacuation
required at this level

MMWR

g/m³)

Eye and skin effects

Special provisions for
darkroom use

ination system for
hazardous

None

Includes definition, safety
data sheets, alert symbols,
and label statements

mg/m³) TWA;
8 mg/m³)

Mucous membrane irritation;
possible cancer threat
in manufacturing process

More stringent work
practices and medical
surveillance required for
manufacturing workers

endation was transmitted to OSHA is in parentheses.

recommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Kepone (January 1976)	None	1 µg/m ³ TWA
Ketones (June 1978)	All are 8-hr TWA values in ppm (mg/m ³): acetone: 1,000 (2,400); methyl ethyl ketone: 200 (590); methyl n-propyl ketone: 200 (700); methyl n-butyl ketone: 100 (410); methyl n-amyl ketone: 100 (465); methyl isobutyl ketone: 100 (410); methyl isoamyl ketone: none; diisobutyl ketone: 50 (290); cyclohexanone: 50 (200); mesityl oxide: 25 (100); diacetone alcohol: 50 (240); isophorone: 25 (140)	All are TWA values in (mg/m ³): acetone: 2 (590); methyl ethyl ketone: 200 (590); methyl n-butyl ketone: 150 (530); n-butyl ketone: 1 (410); methyl n-amyl ketone: 100 (465); methyl isobutyl ketone: 50 (200); methyl isoamyl ketone: 50 (200); diisobutyl ketone: 25 (290); cyclohexanone: 25 (100); mesityl oxide: 10 (410); diacetone alcohol: 5 (240); isophorone: 4 (23)
Land-based oil and gas well drilling, comprehensive safety recommendations for (Technical Guideline September 1983; reaffirmed March 1984 as part of NIOSH testimony at OSHA hearing)	Many aspects covered under the numerous OSHA regulations for General Industry (29 CFR 1910)	Various recommendations for safe work practices and technological improvements

NIOSH Recommendations

Recommended Exposure Limit(s) [†]	Health Effect(s) Considered	Comments
<p>Concentrations in ppm Acetone: 250 Methyl ketone: Methyl n-propyl ketone: 300; methyl isobutyl ketone: 100 Methyl isobutyl ketone: 50 (230); Acetone: 25 (140); Methyl isobutyl ketone: 25 (100); Methyl isobutyl ketone: 10 (40); Methyl isobutyl ketone: 50 (240); Methyl isobutyl ketone: (23)</p>	<p>Nervous system effects; liver cancer</p> <p>Irritation; liver, kidney, and nervous system effects</p>	<p>Liver function testing required</p> <p>Urinalysis required; workers exposed to methyl n-butyl ketone to be warned of nervous system effects</p>
<p>Recommendations for protective and improvement measures</p>	Injury and death	<p>Many tasks, types of equipment, and conditions are not covered by existing regulations</p>

Lead, inorganic
(January 1973;
revised May
1978)

50 $\mu\text{g}/\text{m}^3$, 8-hr TWA;
over 8-hr exposure
to be determined
by formula

< 100 $\mu\text{g}/\text{m}^3$ TWA
to be maintained so
that worker blood lead
remains $\leq 60 \mu\text{g}/\text{L}$

Lockout/tagout,
guidelines for
controlling
hazardous energy
during maintenance
and servicing
(Technical
Guideline
September 1983)

Many aspects covered under
OSHA regulations for General
Industry (29 CFR 1910)
and construction standards
(29 CFR 1926)

Work-practice recom-
mendations for controlling hazardous
energy during main-
tenance and servicing activities

Logging from
felling to
first haul
(July 1976)

None

Extensive work-practice
and personal protection
recommendations

Malathion
(June 1976)

15 mg/m^3 , 8-hr TWA

15 mg/m^3 TWA

Mercury,
inorganic
(August 1973)

0.1 mg/m^3 acceptable
ceiling

0.05 mg/m^3 ,
8-hr TWA

Methyl alcohol
(March 1976)

200 ppm (260 mg/m^3),
8-hr TWA

200 ppm (262 mg/m^3),
800 ppm (1,048 mg/m^3)
(15 min)

Methyl
parathion
(September
1976)

None

0.2 mg/m^3 TWA

*Date recommended

†NIOSH TWA recommended

TWA; air level
ed so
ood lead
 $\mu\text{g}/100\text{g}$

recommendations
hazardous
maintenance
activities

Kidney, blood, and nervous
system effects

Injury and death

Blood monitoring required

"Energy" defined in this
document as kinetic
energy, potential energy,
electrical energy, and
thermal energy

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ick-practice
protection
ions

Primarily trauma and falls

Immunization and first-aid
programs to be instituted

WA

Nervous system effects

Skin contact to be
prevented; blood monitoring
required

MMWR

Central nervous system
and mental effects

Work practices, sanitation,
monitoring, and medical
surveillance emphasized

2 mg/m^3), TWA;
048 mg/m^3) ceiling

Blindness; metabolic
acidosis

None

WA

Nervous system effects

Skin contact to be
prevented; blood monitoring
required

ommendation was transmitted to OSHA is in parentheses.

WA recommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
4,4'-Methylenebis (2-chloroaniline) (Special Hazard Review September 1978)	Standard formally revoked by OSHA, August 1975	3 $\mu\text{g}/\text{m}^3$ TWA (lowest detectable level)
Methylene chloride (March 1976)	500 ppm, 8-hr TWA; 1,000 ppm acceptable ceiling; 2,000 ppm acceptable maximum peak for 5 minutes in any 2-hr period above the acceptable ceiling for an 8-hr shift	75 ppm (261 mg/m^3) 500 ppm (1,740 mg/m^3) (15 min) to be lowered in presence of carbon monoxide
Monohalo-methanes (CIB September 1984)	Methyl chloride: 100 ppm, 8-hr TWA; 200 ppm ceiling; 300 ppm acceptable maximum peak for 5 minutes in any 3-hr period above the acceptable ceiling for an 8-hr shift; methyl bromide: 20 ppm (80 mg/m^3) ceiling (Skin); methyl iodide: 5 ppm (28 mg/m^3), 8-hr TWA (Skin)	Exposure to methyl chloride, methyl bromide, and methyl iodide should be reduced to the lowest feasible level
Niax® Catalyst ESN (Joint NIOSH/ OSHA CIB May 1978)	OSHA and NIOSH recommend that exposure to Niax® Catalyst ESN and its components, dimethylaminopropionitrile and bis [2-(dimethylamino)ethyl] ether, be minimized	

NIOSH Recommendations

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Exposure †	Health Effect(s) Considered	Comments
lowest	Cancer	Chest X-ray; blood and urine testing required
100 mg/m ³ TWA; 100 mg/m ³ ceiling exceeded in carbon monoxide	Central nervous system effects; carbon monoxide toxicity	Blood monitoring required
methyl chloride, and methyl chloride reduced exposure	Cancer; for methyl chloride: cancer and teratogenicity	None
Catalyst and	Urological disorders; nervous system effects	Work-practice and engineering controls to reduce exposure

MMWFR

Nickel carbonyl
(Special Hazard
Review
May 1977)

1 ppb ($7 \mu\text{g}/\text{m}^3$),
8-hr TWA

1 ppb ($7 \mu\text{g}/\text{m}^3$) TWA
(least detectable level)

Nickel,
inorganic
compounds
(May 1977)

1 mg/m^3 , 8-hr TWA

15 $\mu\text{g Ni}/\text{m}^3$ TWA

Nitric acid
(March 1976)

2 ppm ($5 \text{ mg}/\text{m}^3$),
8-hr TWA

2 ppm ($5 \text{ mg}/\text{m}^3$) TWA

Nitriles
(September
1978)

Acetonitrile: 40 ppm
($70 \text{ mg}/\text{m}^3$), 8-hr TWA;
tetramethyl
succinonitrile:
0.5 ppm ($3 \text{ mg}/\text{m}^3$),
8-hr TWA (Skin)

All are TWA values in ppm
(mg/m^3): acetonitrile: 20 (4);
n-butyronitrile: 8 (22);
isobutyronitrile: 8 (22);
propionitrile: 6 (14);
malononitrile: 3 (8);
adiponitrile: 4 (18);
succinonitrile: 6 (20).
All ceiling values (15 min)
in ppm (mg/m^3):
acetone cyanohydrin: 1 (4);
glycolonitrile: 2 (5);
tetramethyl succinonitrile:
When present as mixtures
other sources of cyanide,
exposure to be considered
additive and environmental
limit to be calculated

*Date recommendation

†NIOSH TWA recommen

	Cancer	Chest X-ray, pulmonary function testing, and urine monitoring required
	Skin effects; lung and nasal cancer	Chest X-ray and pulmonary function testing required
	Dental erosion; nasal/lung irritation	Skin and eye contact to be prevented; chest X-ray required
ppm : 20 (34);); 2);	Hepatic, renal, respiratory, cardiovascular, gastrointestinal, and nervous system effects	Chest X-ray and pulmonary function testing required; trained personnel and first-aid kits to be available during use; skin and eye contact to be prevented
min)		
: 1 (4);		
nitrile: 1 (6). tures or with nide, sidered mental		

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ation was transmitted to OSHA is in parentheses.
ommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit (REL)
Nitrogen oxides (March 1976)	NO ₂ : 5 ppm (9 mg/m ³) ceiling; NO: 25 ppm (30 mg/m ³), 8-hr TWA	NO ₂ : 1 ppm (1.8 ceiling (15 min); NO: 25 ppm (30
Nitroglycerin and ethylene glycol dinitrate (EGDN) (June 1978)	Nitroglycerin: 2 mg/m ³ , (0.2 ppm) ceiling (Skin); EGDN: 1 mg/m ³ (0.2 ppm) ceiling (Skin)	0.1 mg/m ³ ceiling recommended li either substance or mixtures
2-Nitronaphthalene (CIB December 1976)	None	Reduce exposure lowest feasible l
2-Nitropropane (CIB April 1977; revised October 1980 in Joint OSHA/NIOSH Health Hazard Alert)	25 ppm (90 mg/m ³), 8-hr TWA	Reduce exposure lowest feasible l
Noise (August 1972)	90 dBA, 8-hr TWA	85 dBA TWA; 1
Organotin compounds (November 1976)	0.1 mg tin/m ³ , 8-hr TWA	0.1 mg tin/m ³ T

NIOSH Recommendations

Recommended limit(s) [†]	Health Effect(s) Considered	Comments
1.8 mg/m ³ (10 min); 30 mg/m ³ TWA	Respiratory effects; blood effects	Pulmonary function testing required
ceiling (20 min) exposed limit for skin contact alone	Circulatory system effects	Skin contact to be prevented
Exposure to permissible level	Cancer	Compound metabolizes to beta-naphthylamine, a known carcinogen
Exposure to permissible level	Cancer	Medical monitoring with specific emphasis on liver function tests
115 dBA ceiling	Hearing damage	None
5 mg/m ³ TWA	Eye, skin, liver, nervous system, and heart effects	Chest X-ray, blood and urine monitoring, eye tests, heart examination, and nervous system testing required; skin and eye contact to be prevented

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Paint and allied
coating products,
manufacture of
(September 1984)

Many aspects covered
under the numerous OSHA
regulations for
General Industry
(29 CFR 1910)

Various recommenda-
tions for the handling of raw
materials and finished
products; dispersion of
pigment or resin parti-
cles; thinning, tinting, and
shading; filling; and
laboratory functions

Parathion
(June 1976)

0.1 mg/m³, 8-hr TWA
(Skin)

0.05 mg/m³ TWA

Pesticide
manufacturing
and formulation
(July 1978)

Current OSHA PEL's or previous NIOSH REL's to be
followed; stringent work-practice and medical surveillance
requirements to be instituted. Pesticides considered in
groups based on toxicity

Phenol
(July 1976)

5 ppm (19 mg/m³),
8-hr TWA (Skin)

5.2 ppm (20 mg/m³)
15.6 ppm (60 mg/m³)
(15 min)

Phenyl-beta-
naphthylamine (CIB
December 1976)

None

Reduce exposure to
lowest feasible level

Phosgene
(February 1976)

0.1 ppm (0.4 mg/m³),
8-hr TWA

0.1 ppm (0.4 mg/m³)
0.2 ppm (0.8 mg/m³)
ceiling (15 min)

Polychlorinated
biphenyls
(September
1977)

42% chlorine: 1 mg/m³,
8-hr TWA; 54% chlorine:
0.5 mg/m³, 8-hr TWA

1 µg/m³ TWA

*Date recommended

†NIOSH TWA recommended

Recommendations for
raw
finished
version of
in particles;
, and
; and
tions

WA

e
veillance
and in

g/m³) TWA;
mg/m³) ceiling

ure to
level

ng/m³) TWA;
ng/m³)
)

Recommendation was transmitted to OSHA in parentheses.

WA recommendations are based on exposures up to 10 hours unless otherwise noted.

Injury and a wide range
of toxicities considered

Nervous system effects

Wide range of toxicities
considered; nervous and
reproductive system
effects; cancer

Skin, eye, central nervous
system, liver, and
kidney effects

Cancer

Respiratory effects

Cancer; skin, liver, and
reproductive effects

Paint and allied coating
products include paints,
varnishes, lacquers, stains,
putties, and paint and
varnish removers

Skin contact to be
prevented; blood monitoring
required

Blood monitoring required
for some groups; workers
to be warned of reproductive
effects for some
compounds; skin contact to
be prevented

Skin and eye contact
to be prevented

Compound metabolizes to
beta-naphthylamine,
a known carcinogen

Pulmonary function
testing and X-ray
required

Blood testing required;
women workers of child-
bearing age and nursing
mothers to be warned
of potential adverse
effects

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Precast concrete products industry, comprehensive safety recommendations for (Technical Guideline June 1984)	Many aspects covered under the numerous OSHA regulations for General Industry (29 CFR 1910)	Various recommendations for safe work practices and worker training
Refined petroleum solvent (July 1977)	2,900 mg/m ³ (500 ppm), 8-hr TWA (Stoddard solvent)	Kerosene 100 mg/m ³ other solvents: 350 mg/m ³ TWA; 1,800 mg/m ³ ceiling (15 min)
Silica, crystalline (November 1974)	250/‰SiO ₂ +5 in mppcf, or 10 mg/m ³ /‰SiO ₂ +2 (respirable quartz)	50 µg/m ³ TWA, respirable free silica
Sodium hydroxide (September 1975)	2 mg/m ³ , 8-hr TWA	2 mg/m ³ ceiling (15 min)
Styrene (September 1983)	100 ppm, 8-hr TWA; 200 ppm acceptable ceiling; 600 ppm maximum ceiling (5 min in 3 hr)	50 ppm (213 mg/m ³) 100 ppm (426 mg/m ³)

NIOSH Recommendations

Exposure Conditions [†]	Health Effect(s) Considered	Comments
Working conditions practices existing	Injury and death	Equipment, conditions, and many of the tasks specific to the industry are not covered under the existing regulations
50 mg/m ³ TWA; all 50 mg/m ³ ceiling	Skin, lung, and nerve irritation	Blood and urine monitoring required; action level for petroleum ether, rubber solvent, naphtha: 200 mg/m ³ TWA; action level for mineral spirits and Stoddard solvent: 350 mg/m ³ TWA; action level for kerosene: 100 mg/m ³ TWA; skin contact to be prevented
Respirable	Chronic lung disease (silicosis)	X-ray, pulmonary function testing required
(15 min)	Respiratory irritation	Skin and eye contact to be prevented
50 mg/m ³ TWA; 50 mg/m ³ ceiling	Nervous system effects; eye and respiratory system irritation	Action level set at 25 ppm; skin contact to be prevented; workers to be warned of possible adverse reproductive effects

Sulfur dioxide
(February 1974;
revised May
1977 as part
of NIOSH
testimony
at OSHA
hearing)

5 ppm (13 mg/m³),
8-hr TWA

0.5 ppm (1.3 mg/m³) TWA

Sulfuric acid
(June 1974)

1 mg/m³, 8-hr TWA

1 mg/m³ TWA

1,1,2,2-Tetra-
chloroethane
(December 1976;
revised in CIB
August 1978)

5 ppm (35 mg/m³),
8-hr TWA (Skin)

Reduce exposure to
lowest feasible level

Tetrachloro-
ethylene
(July 1976;
revised
January 1978
in CIB)

100 ppm, 8-hr TWA;
200 ppm acceptable
maximum ceiling;
300 ppm maximum ceiling
(5 min in 3 hr)

Minimize workplace exp-
levels; limit number of
workers exposed

*Date recommended

†NIOSH TWA recom-

3) TWA

Respiratory effects

Pulmonary function testing
required

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Pulmonary irritation

Skin and eye contact
to be prevented

Cancer; liver, gastro-
intestinal, and nervous
system effects

Skin contact to be
prevented; blood monitoring
required

e exposure
r of

Cancer

None

MMWR

endation was transmitted to OSHA is in parentheses.

Recommendations are based on exposures up to 10 hours unless otherwise noted.

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**Potential
Hazard***

**OSHA
Standard**

**NIOSH Recommended
Exposure Limit(s)†**

Thiols:
n-alkane mono,
cyclohexane,
and benzene
(September
1978)

Butylmercaptan: 10 ppm
(35 mg/m³), 8-hr TWA;
ethylmercaptan: 10 ppm
(25 mg/m³) ceiling;
methylmercaptan: 10 ppm
(20 mg/m³) ceiling

All values in ppm (mg/m³)
ceilings 15 min:
1-methanethiol: 0.5 (1.1)
1-ethanethiol: 0.5 (1.3)
1-propanethiol: 0.5 (1.4)
1-butanethiol: 0.5 (1.8)
1-pentanethiol: 0.5 (2.0)
1-hexanethiol: 0.5 (2.4)
1-heptanethiol: 0.5 (2.6)
1-octanethiol: 0.5 (3.0)
1-nonanethiol: 0.5 (3.3)
1-decanethiol: 0.5 (3.6)
1-undecanethiol: 0.5 (3.9)
1-dodecanethiol: 0.5 (4.2)
1-hexadecanethiol: 0.5 (4.8)
1-octadecanethiol: 0.5 (5.4)
cyclohexanethiol: 0.5 (5.4)
benzenethiol: 0.1 (0.5)
mixtures of thiols to be
controlled by calculation
equivalent concentration

o-Tolidine
(August 1978)

None

20 µg/m³ ceiling (80 µg/m³)

Toluene
(January
1974)

200 ppm, 8-hr TWA;
300 ppm acceptable
ceiling; 500 ppm
maximum ceiling
(10 min)

100 ppm (375 mg/m³)
8-hr TWA; 200 ppm (750 mg/m³)
ceiling (10 min)

NIOSH Recommendations

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Exposure †	Health Effect(s) Considered	Comments
<p>mg/m³),</p> <p>5 (1.0);</p> <p>1 (1.3);</p> <p>5 (1.6);</p> <p>1 (1.8);</p> <p>5 (2.1);</p> <p>5 (2.4);</p> <p>5 (2.7);</p> <p>5 (3.0);</p> <p>5 (3.3);</p> <p>5 (3.6);</p> <p>0.5 (3.9);</p> <p>0.5 (4.1);</p> <p>pl: 0.5 (5.3);</p> <p>tl: 0.5 (5.9);</p> <p>0.5 (2.4);</p> <p>(0.5);</p> <p>to be</p> <p>ulation of</p> <p>trations</p>	<p>Irritation; eye, skin,</p> <p>blood, and nervous system</p> <p>effects</p>	<p>Blood and urine monitoring</p> <p>required; skin contact</p> <p>to be prevented</p>
<p>(80 min)</p>	<p>Nasal irritation; cancer</p>	<p>Urine testing required;</p> <p>quarterly urine monitoring</p> <p>recommended; skin</p> <p>contact to be prevented</p>
<p>g/m³),</p> <p>pm (750 mg/m³)</p>	<p>Central nervous system</p> <p>depressant</p>	<p>None</p>

MMWR

Toluene diisocyanate (July 1973; revised—See Diisocyanates, September 1978)

0.02 ppm (0.14 mg/m³) ceiling

0.005 ppm (0.036 mg/m³)
0.02 ppm (0.14 mg/m³) (20 min)

1,1,1-Trichloroethane (July 1976)

350 ppm (1,900 mg/m³), 8-hr TWA

350 ppm (1,910 mg/m³) (15 min)

1,1,2-Trichloroethane (CIB August 1978)

10 ppm (45 mg/m³), 8-hr TWA (Skin)

Reduce exposure to lowest feasible level

Trichloroethylene (July 1973; revised in Special Hazard Review, February 1978)

100 ppm, 8-hr TWA; 200 ppm acceptable ceiling; 300 ppm maximum ceiling (5 min in 2 hr)

25 ppm TWA

Trimellitic anhydride (CIB February 1978)

None

Should be handled in the workplace as an extremely toxic substance

Tungsten and cemented tungsten carbide (September 1977)

None

Insoluble tungsten: 5 mg TWA; soluble tungsten: TWA; dust of cemented carbide (containing > 2% 0.1 mg cobalt/m³ TWA; of cemented tungsten carbide (containing > 0.3% nickel) 15 µg nickel/m³ TWA

*Date recommendation

†NIOSH TWA recommendation

mg/m ³) TWA; (m ³) ceiling	Respiratory effects	Chest X-rays, blood tests, pulmonary function testing required
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g/m ³) ceiling	Nervous system, liver, and heart effects	Action level set at 200 ppm TWA; medical warning of possible congenital abnormalities required
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	Cancer	None
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	Cancer; central nervous system depressant	Workers to be warned of hazards; 25 ppm level can be achieved by use of existing engineering control technology
--	--	--

MMWR

in a stance	Pulmonary edema; immuno- logical sensitization; irritation of pulmonary tract, eyes, nose, and skin	Limit exposure to as few workers as possible while minimizing workplace levels
-------------------	--	--

5 mg/m ³ sten: 1 mg/m ³ nted tungsten > 2% cobalt); TWA; dust en carbide nickel); TWA	Lung and skin effects	Pulmonary function testing and chest X-ray required
--	-----------------------	--

Information was transmitted to OSHA is in parentheses.

Recommendations are based on exposures up to 10 hours unless otherwise noted.

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Potential Hazard*	OSHA Standard	NIOSH Recommended Exposure Limit(s) [†]
Ultraviolet radiation (December 1972)	10 mW/cm ² averaged over any 0.1-hr period	1.0 mW/cm ² for periods ≤ 1 sec; 1,000 mW (1.0 J/cm ²) for periods ≤ 1,000 sec
Vanadium (August 1977)	Vanadium pentoxide (dust): 0.5 mg/m ³ ceiling; (fume): 0.1 mg/m ³ ceiling; ferrovanadium: 1 mg/m ³ , 8-hr TWA	Vanadium compounds: 0.5 mg/m ³ ceiling (15 min); metallic vanadium and vanadium compounds: 1 mg/m ³ TWA
Vibration syndrome (CIB March 1983)	None	Jobs should be redesigned to minimize the use of vibrating handtools; power handtools should be redesigned to minimize vibration
Vinyl acetate (September 1978)	None	4 ppm (15 mg/m ³) ceiling (15 min)
Vinyl chloride (March 1974; reaffirmed June 1974 as part of NIOSH testimony at OSHA hearing)	1 ppm, 8-hr TWA; 5 ppm ceiling (15 min)	Lowest reliably detectable level; air-supplied respirator with auxiliary self-contained air supply to be worn

NIOSH Recommendations

Exposure Scenario	Health Effect(s) Considered	Comments
Exposure periods > 1,000 hours; 0.05 J/cm ² sec/cm ² or less	Skin and eye effects	None
Exposure periods: 0.05 mg/m ³ or less; metallic dusts; sodium carbide:	Eye, skin, and lung effects	Pulmonary function testing and chest X-ray required
Exposure periods: designed for use of powered equipment	Vibration syndrome; adverse circulatory and neural effects in the fingers	None
Exposure periods: ceiling	Irritation	None
Exposure periods: detectable respirator contained form	Liver cancer	Liver function testing required

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Vinyl halides
(September
1978)

None except for
vinyl chloride

Vinyl halides to be
controlled as specific
for vinyl chloride in 2
CFR 1910.1017 with
eventual goal of
zero exposure

Waste anesthetic
gases and
vapors
(May 1977)

None for substances
when used as
anesthetic agents

Halogenated anesthetics
2 ppm ceiling (1 hr);
oxide: 25 ppm TWA
of use

Xylene
(May 1975)

100 ppm (435 mg/m³),
8-hr TWA

100 ppm (434 mg/m³)
200 ppm (868 mg/m³)
(10 min)

Zinc oxide
(October 1975)

5 mg/m³, 8-hr TWA

5 mg/m³ TWA; 15 mg/m³
ceiling (15 min)

11R161058508

*Date recommended

†NIOSH TWA recommended

be
pecified
le in 29
7 with
f

esthetic agents:
1 hr); nitrous
TWA during periods

mg/m³) TWA;
mg/m³) ceiling

; 15 mg/m³
)

Cancer

Reproductive effects and
audiovisual performance
decrements

Central nervous system
depressant; respiratory
irritation

Metal fume fever

Vinyl halides include vinyl
chloride, vinylidene
chloride, vinyl bromide,
vinyl fluoride, and
vinylidene fluoride
monomers

Workers to be advised of
potential effects; abnormal
outcome of pregnancies of
workers and spouses to be
documented

None

None

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MMWR

ommendation was transmitted to OSHA is in parentheses.
A recommendations are based on exposures up to 10 hours unless otherwise noted.

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